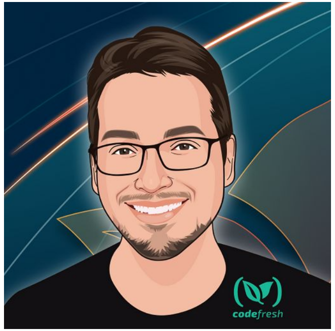
codefresh

How We Securely Scaled Multi-Tenancy with vcluster, Crossplane, and Argo CD

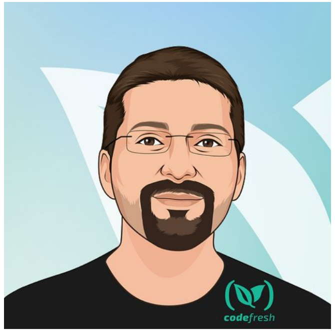
Kubecon 2023 Amsterdam

Your hosts



Ilia Medvedev

DevOps Engineer - Codefresh



Kostis Kapelonis

Developer Advocate - Codefresh

Let’s set the stage

Provide hosted Argo CD to the masses?

About Codefresh

- ## Modern Deployment Platform

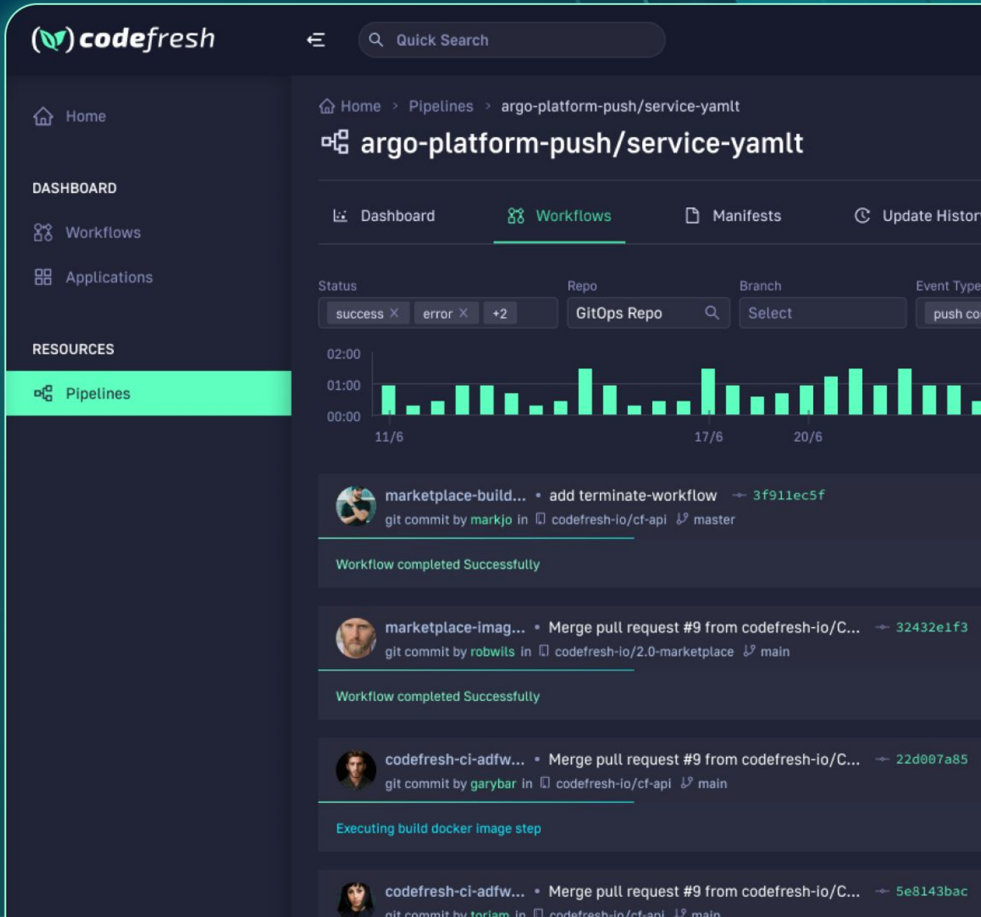
  Comes with CI, CD and GitOps modules

- ## Enterprise Ready

  Code-to-cloud visibility across apps and clusters

- ## Continuous Delivery

  Progressive delivery without compromising stability powered by Argo CD and Argo Rollouts



Status: success ✕ error ✕ +2

Repo: GitOps Repo

Branch: Select

Event Type: push co

marketplace-build... • add terminate-workflow 3f911ec5f
git commit by markjo in codefresh-io/cf-api master
Workflow completed Successfully

marketplace-imag... • Merge pull request #9 from codefresh-io/C... 32432e1f3
git commit by robwils in codefresh-io/2.0-marketplace main
Workflow completed Successfully

codefresh-ci-adfw... • Merge pull request #9 from codefresh-io/C... 22d007a85
git commit by garybar in codefresh-io/cf-api main
Executing build docker image step

codefresh-ci-adfw... • Merge pull request #9 from codefresh-io/C... 5e8143bac
git commit by toriam in codefresh-io/cf-api main

Goals

- Allow customers to sign-up
- Offer an Argo CD instance to EACH customer account
- SAAS platform is open to anybody
- We don’t know the number of users in advance
- Essentially we want hosted Argo CD instances

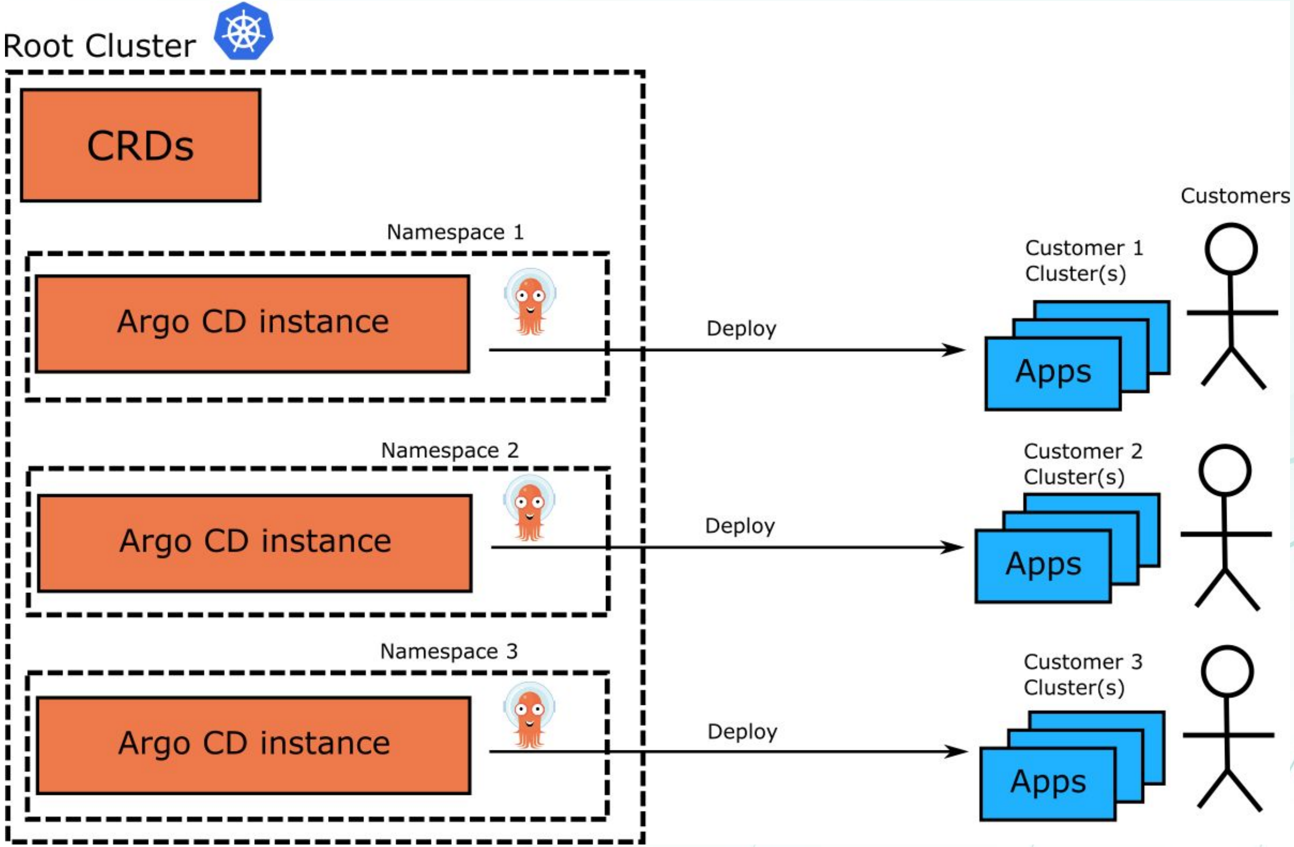
Meme without a picture^{TM}

" You get an Argo CD instance, you get an Argo CD instance, everybody gets their own Argo CD instance"

Options, Options, Options

Possible solutions

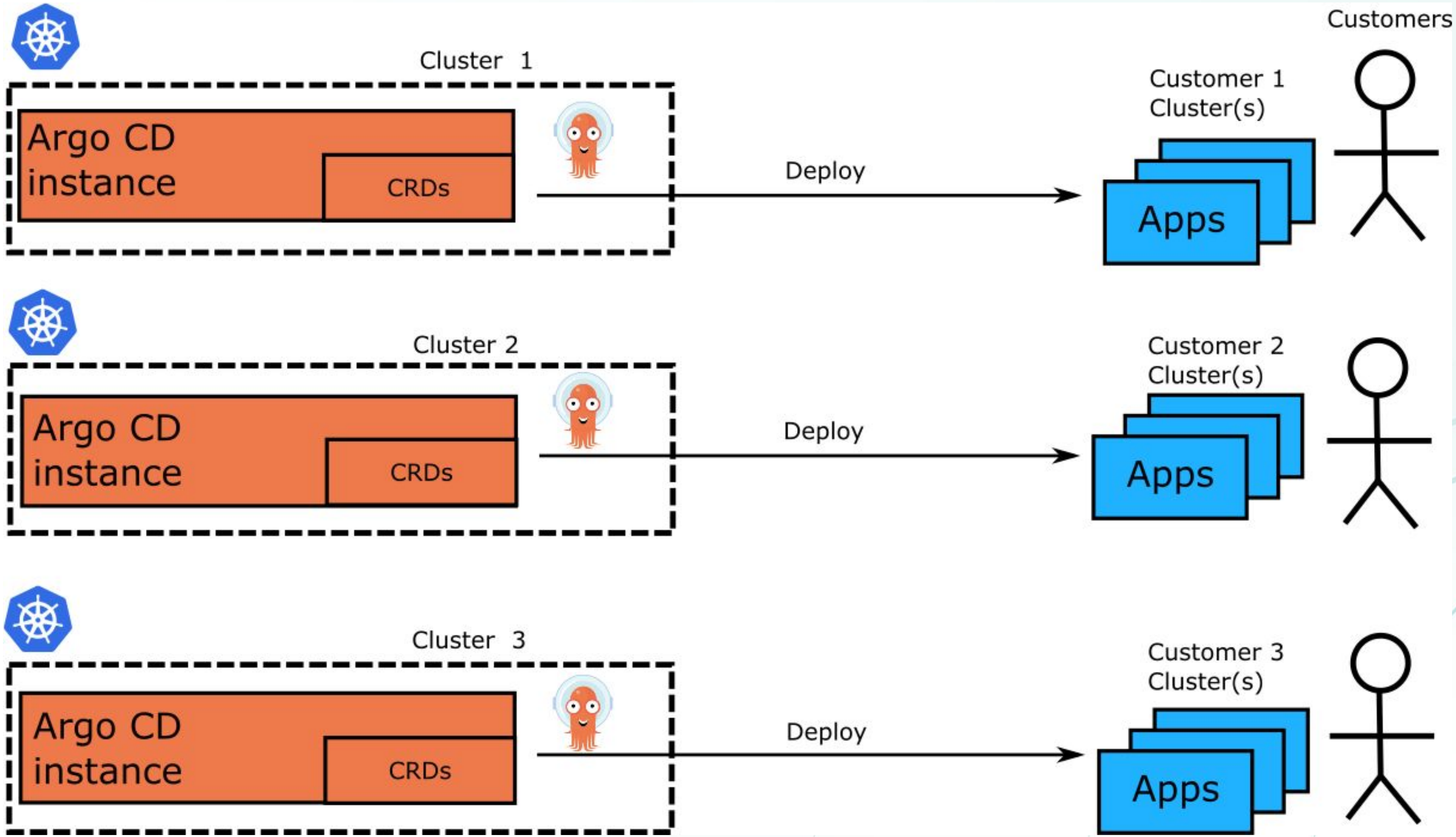
Argo CD per namespace



Single cluster to house all Argo CD instances

- Centralized management ✅
- Resource efficient ✅
- Fast setup (namespace based) ✅
- Need to setup policies/quotas/isolation ❌
- “Noisy neighbor” issues ❌
- Argo CD itself has CRDs ❌
- Same cluster version for everybody ❌

Argo CD per cluster



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New cluster per account

- Total isolation ✅
- Different cluster version per customer ✅
- No issues with Argo CD CRDs ✅
- Cloud cost issues❌
- Slow to setup (wait for new cluster) ❌
- Difficult management ❌

Single cluster/multiple ns

✅ - Centralized management
✅ - Cost Effective
✅ - Common resources
✅ - Fast init

❌- No isolation
❌- Tenant confined to namespace
❌- Same K8s version for everybody
❌- CRDs hard to handle
❌- Resource starvation

Multiple clusters

✅ - Great isolation
✅ - Full cluster access for tenant
✅ - No issues with CRDs
✅ - K8s version flexibility

❌ - Complex management
❌ - Expensive
❌ - No Resource sharing
❌ - Slow init

What about Security?

- Argo CD has network access to target deployment clusters (including production)
- Compromising Argo CD could compromise production
- Tenants should never get access to other Argo CD instances than their own

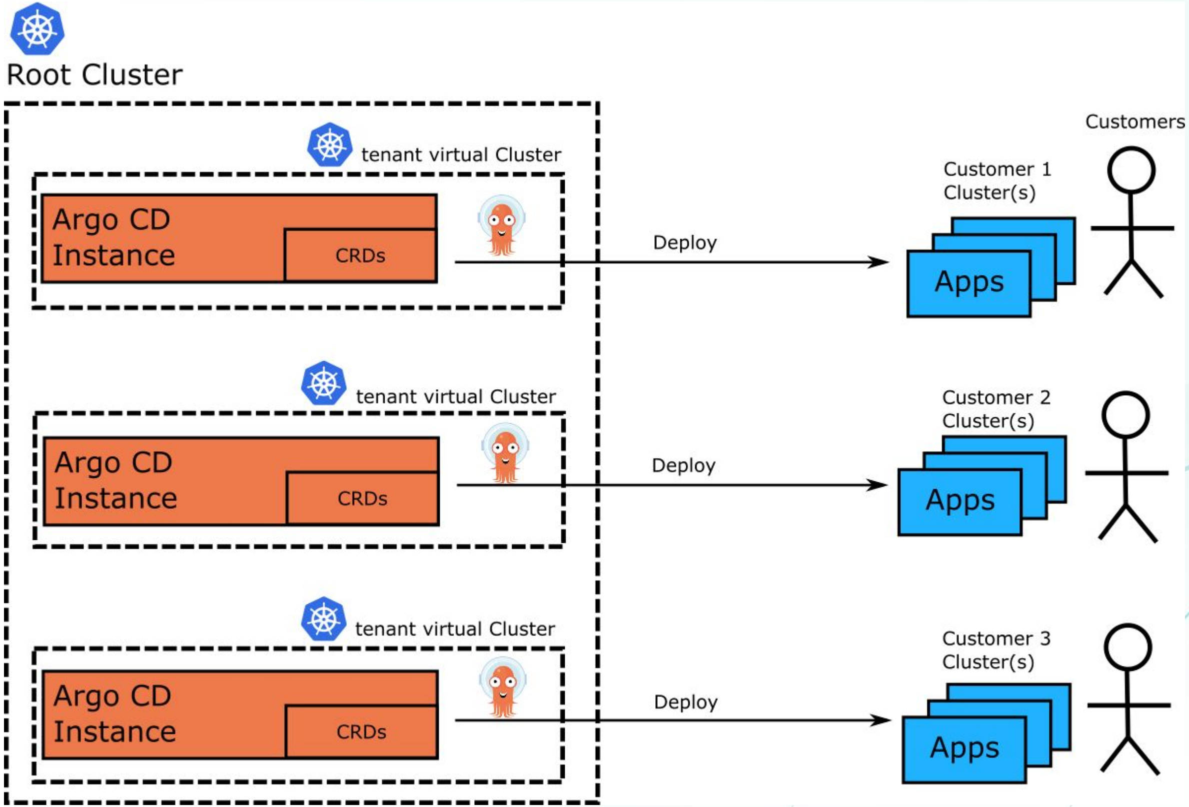
New kid on the block

Enter Virtual cluster

Virtual Kubernetes clusters

- vcluster.com
- Open source project by Loft Labs
- Cluster within a cluster
- Fully Kubernetes compliant

Virtual Kubernetes clusters



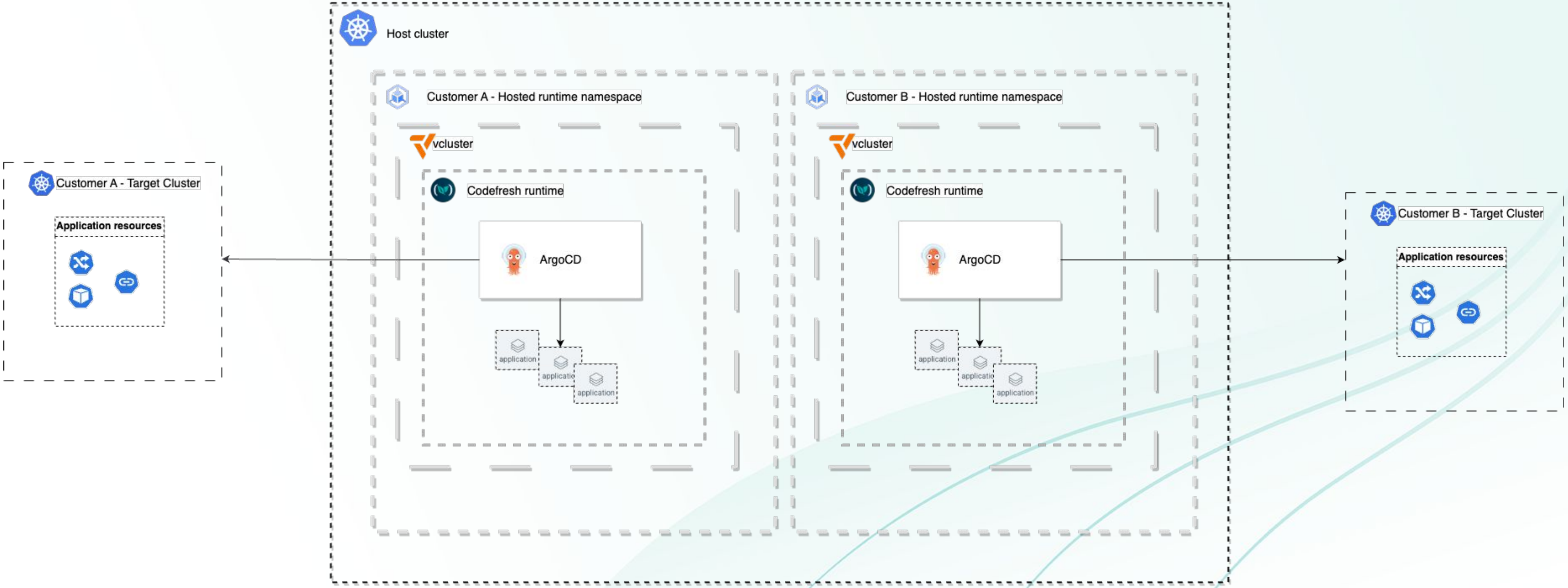
Get the best of both worlds

✅ - Good isolation
✅ - Full cluster access for tenant
✅ - Cost effective
✅ - No issues with CRDs
✅ - Centralized management
✅ - Common resources
✅ - Fast init
✅ - K8s Version flexibility

❌ - Some hardening required
❌ - Host cluster is SPF

Implementation

Solution Architecture



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vcluster concepts

vclusters are deployed on the host cluster just like any other workload- using plain manifests or a Helm chart.

vclusters are entirely namespace scoped hence their installation does not require cluster admin privileges.

High level resources are virtual (Deployments, Statefulsets,CRD’s)

Low level resources that are required for workloads to run are synced to the host (Pods, Secrets, etc)

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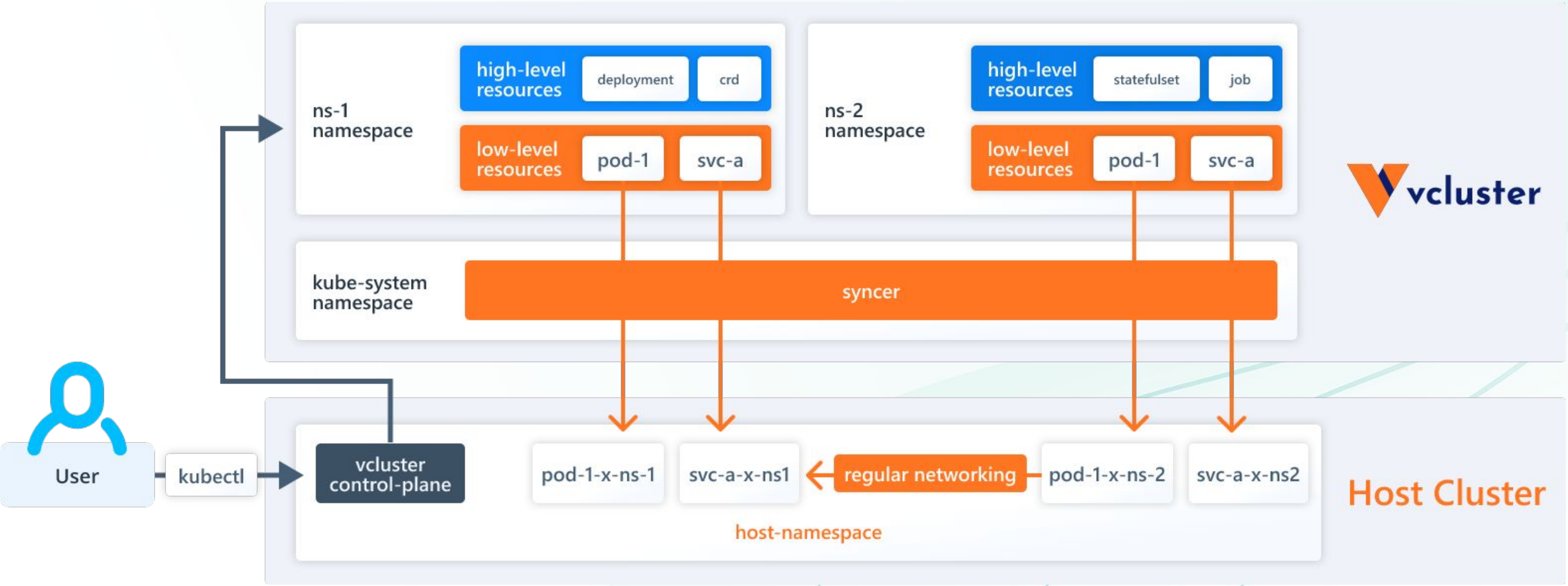


https://www.vcluster.com/docs/architecture/basics

Scaling and automation

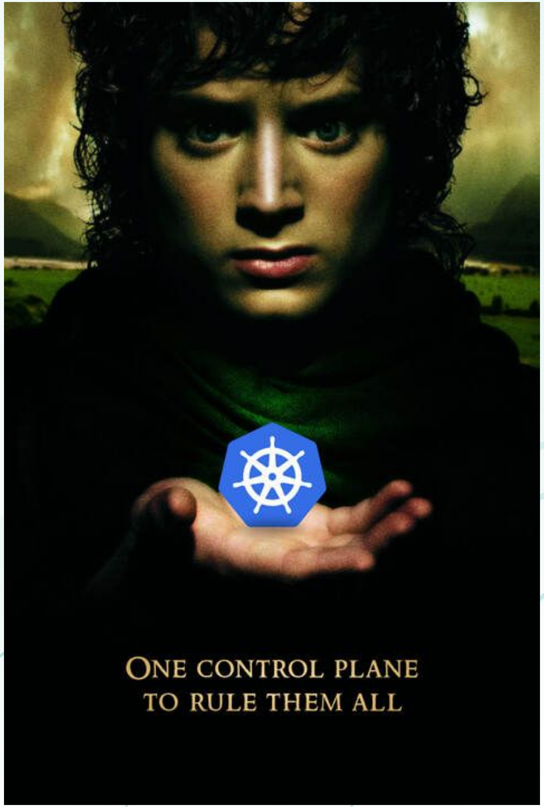
- To deploy a single Argo CD instance (Codefresh runtime) we need to:
  - Deploy vcluster Helm chart
  - Deploy the runtime workloads onto the vcluster - Also using Helm.

- The challenge - Since vcluster has its own Kube API, it's not as simple as deploying workloads to the same cluster.

- Maybe we should treat vcluster as a piece of infrastructure, and consider tools that belong to infrastructure provisioning domains?

Enter Crossplane 🍦

- Kubernetes native.
- Manages non-Kubernetes resources using Kubernetes CRD’s. Even pizza orders!
- Crossplane utilizes Kubernetes control loops to serve as a general purpose control plane that among other things can be used for infrastructure provisioning and lifecycle.



Provisioning infra with crossplane

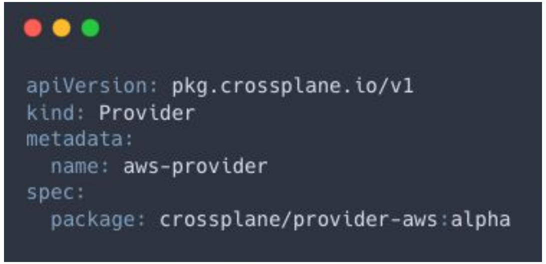
To provision infrastructure with crossplane we use providers and resources:

- Resources - Are represented using Kubernetes CRD’s and describe the resource we want to provision.

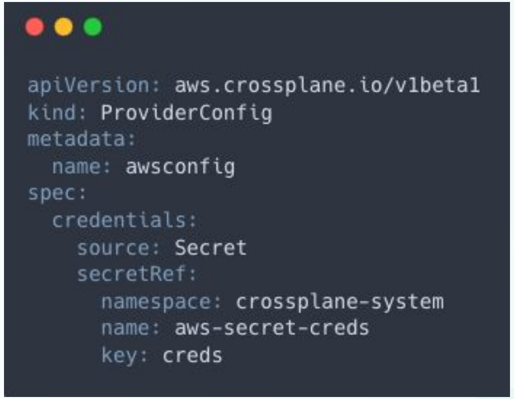
- Providers - Are Kubernetes controllers that manage those resources and provision the infrastructure by invoking 3rd party API’s

- Provider config - Defines how the provider should create resources. For example which credentials to use against the infrastructure provider.

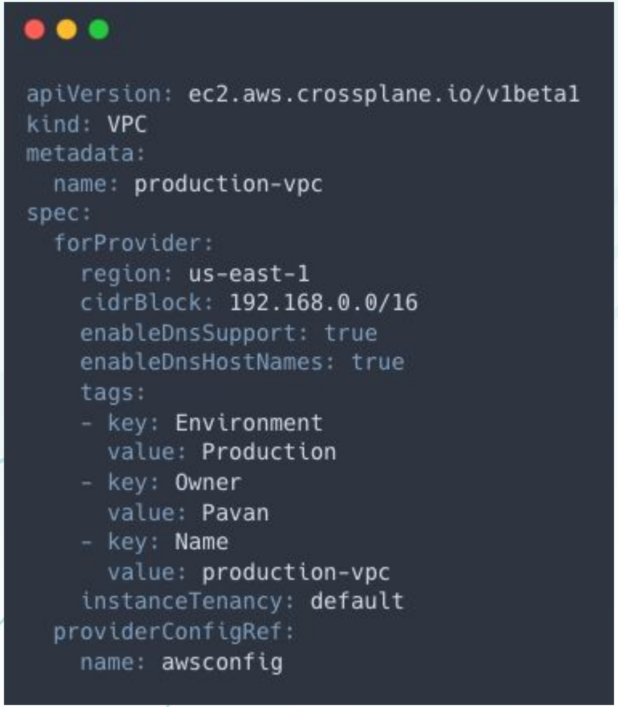
Crossplane example - AWS VPC



```yaml
apiVersion: pkg.crossplane.io/v1
kind: Provider
metadata:
  name: aws-provider
spec:
  package: crossplane/provider-aws:alpha
```



```yaml
apiVersion: aws.crossplane.io/v1beta1
kind: ProviderConfig
metadata:
  name: awsconfig
spec:
  credentials:
    source: Secret
    secretRef:
      namespace: crossplane-system
      name: aws-secret-creds
      key: creds
```



```yaml
apiVersion: ec2.aws.crossplane.io/v1beta1
kind: VPC
metadata:
  name: production-vpc
spec:
  forProvider:
    region: us-east-1
    cidrBlock: 192.168.0.0/16
    enableDnsSupport: true
    enableDnsHostNames: true
    tags:
    - key: Environment
      value: Production
    - key: Owner
      value: Pavan
    - key: Name
      value: production-vpc
    instanceTenancy: default
  providerConfigRef:
    name: awsconfig
```

Crossplane composition

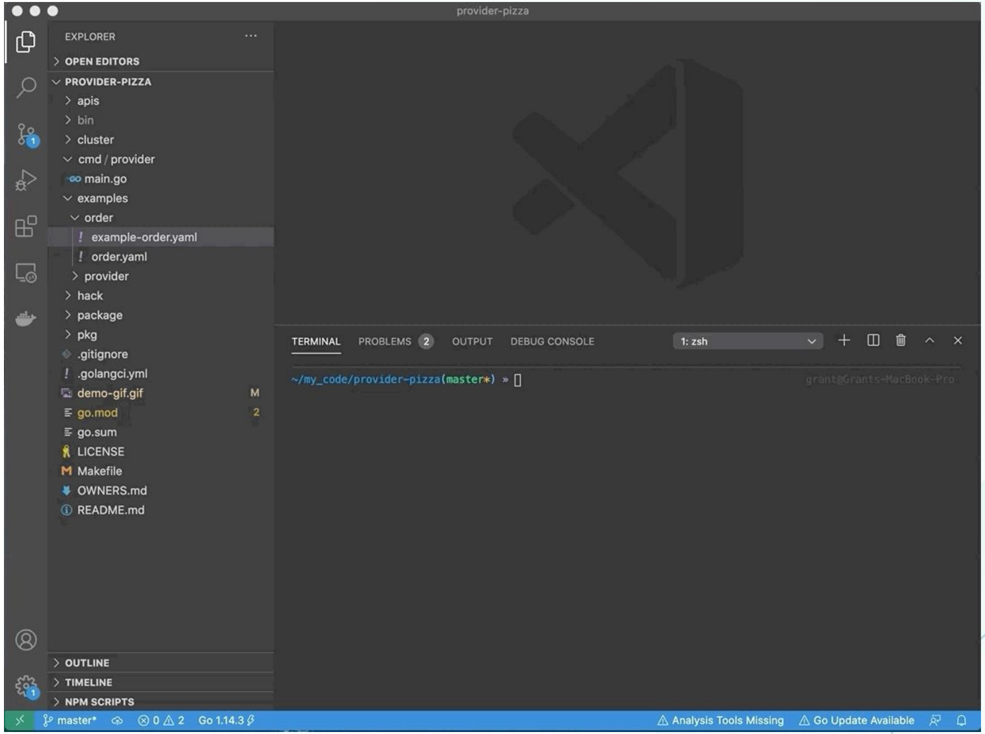
- One of the most powerful features of Crossplane is the ability to create composite resources. Composite resources may utilize multiple provisioners.

- Create your own CRD and reuse existing controllers.

- An example of such use case would be to provision a GKE cluster using GCP provider and once the cluster is deployed use Kubernetes provider to deploy ArgoCD onto the cluster.

https://github.com/crossplane-contrib/provider-kubernetes/blob/main/examples/in-composition/composition.yaml

Learn how to order a pizza with Crossplane!



```
~/my_code/provider-pizza(master*) » []                    grant@Grants-MacBook-Pro
```

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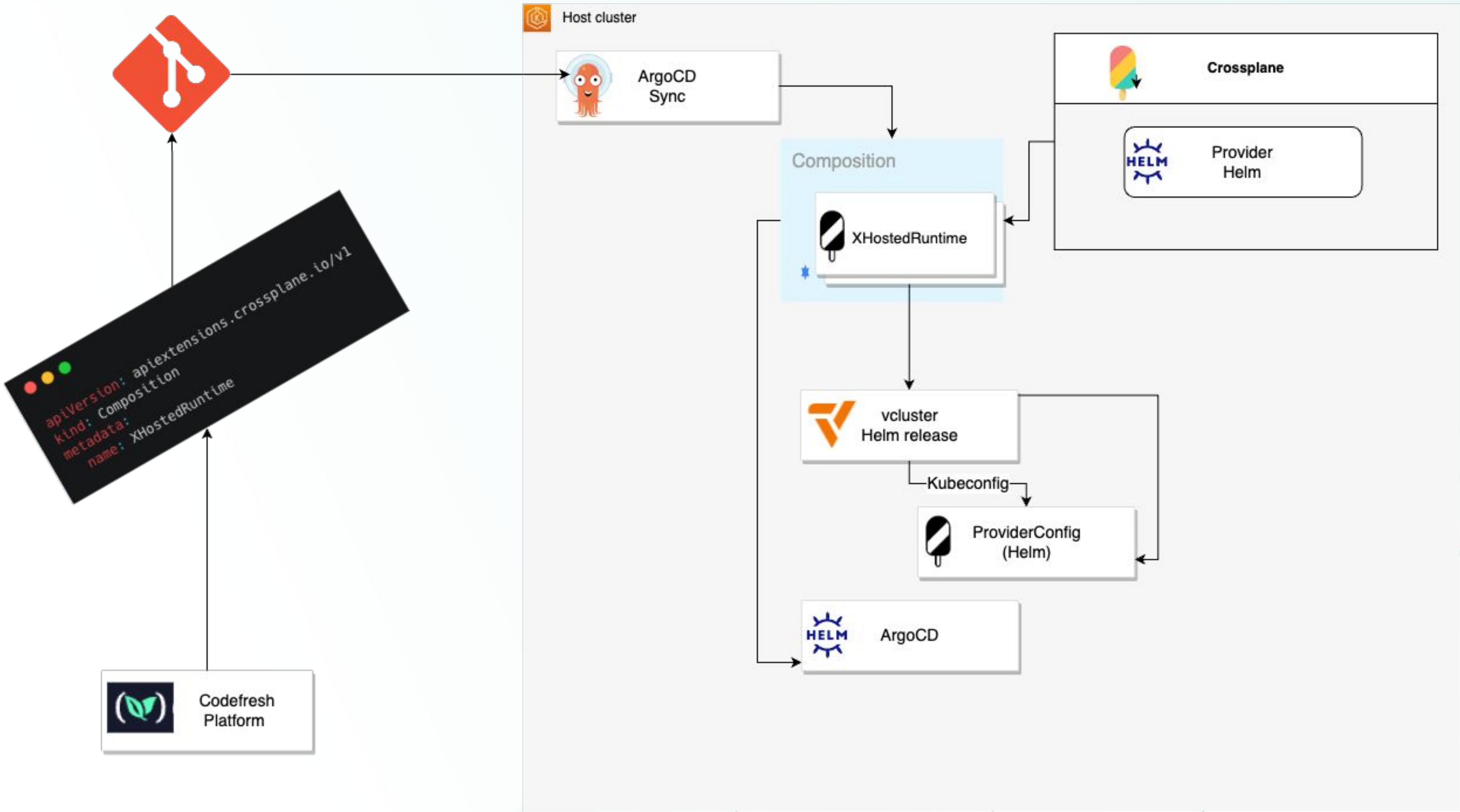
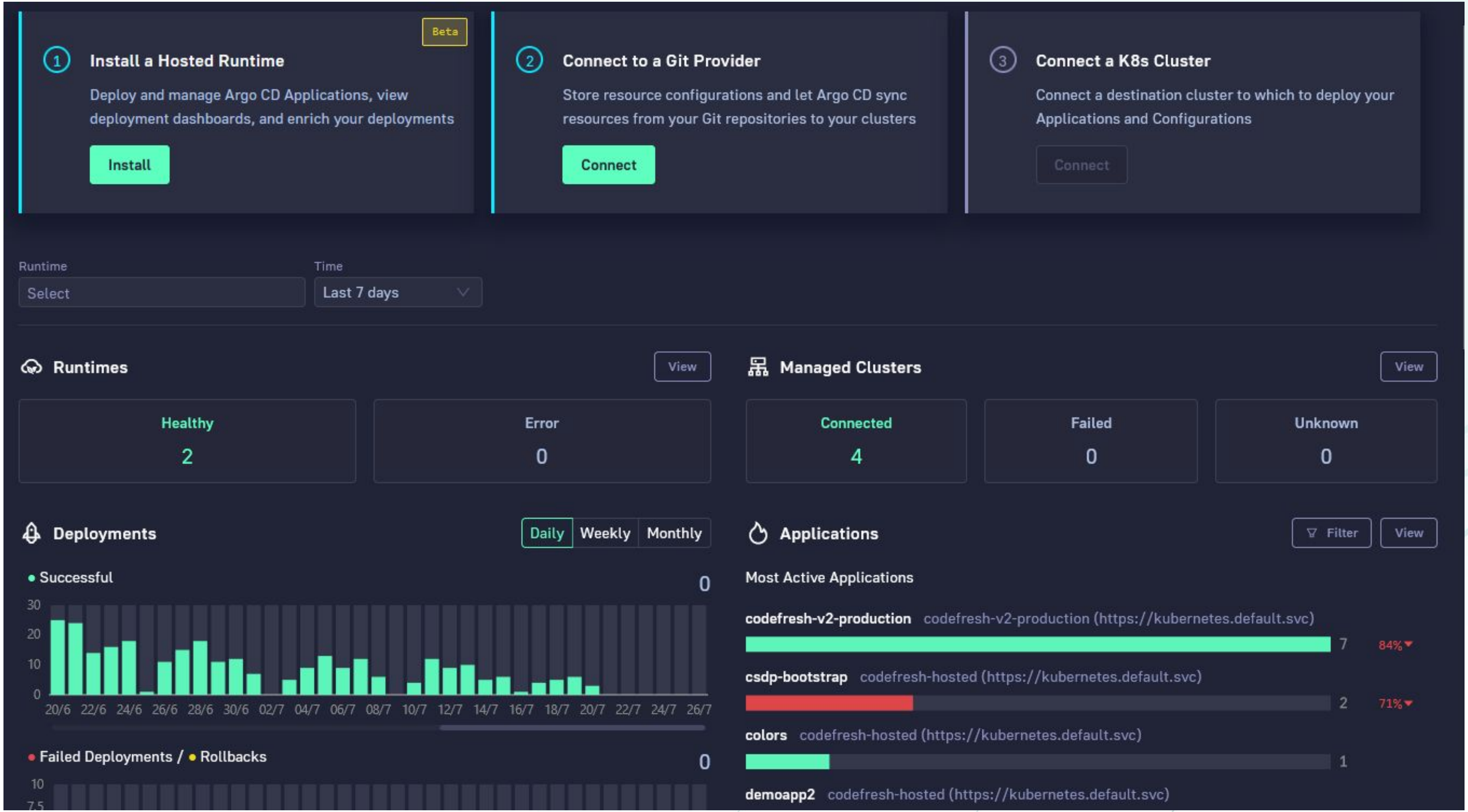
Hosted ArgoCD creation flow



```
apiVersion: apiextensions.crossplane.io/v1
kind: Composition
metadata:
  name: XHostedRuntime
```

How it looks

End user experience



Beta

1 **Install a Hosted Runtime**

Deploy and manage Argo CD Applications, view deployment dashboards, and enrich your deployments

Install

2 **Connect to a Git Provider**

Store resource configurations and let Argo CD sync resources from your Git repositories to your clusters

Connect

3 **Connect a K8s Cluster**

Connect a destination cluster to which to deploy your Applications and Configurations

Connect

Runtime: Select

Time: Last 7 days

Runtimes View

Healthy	Error
2	0

Managed Clusters View

Connected	Failed	Unknown
4	0	0

Deployments Daily Weekly Monthly

● Successful 0

● Failed Deployments / ● Rollbacks 0

Applications Filter View

Most Active Applications

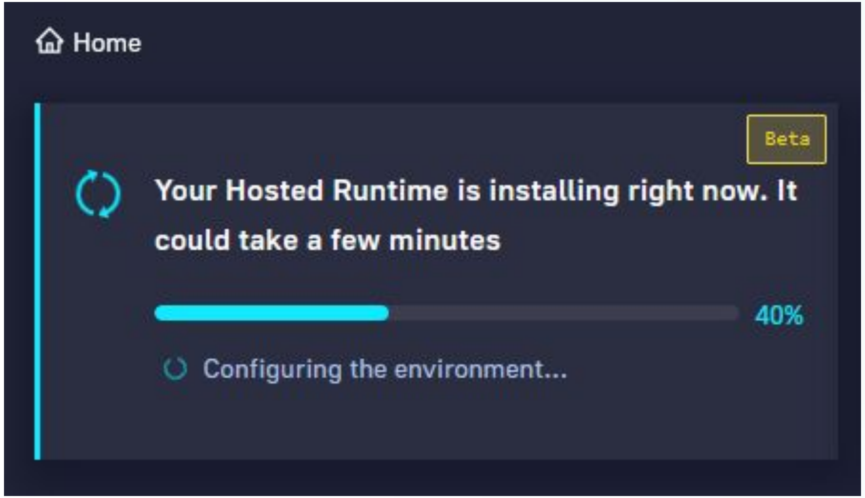
codefresh-v2-production codefresh-v2-production (https://kubernetes.default.svc) 7 84%▾

csdp-bootstrap codefresh-hosted (https://kubernetes.default.svc) 2 71%▾

colors codefresh-hosted (https://kubernetes.default.svc) 1

demoapp2 codefresh-hosted (https://kubernetes.default.svc)

GUI abstracts everything



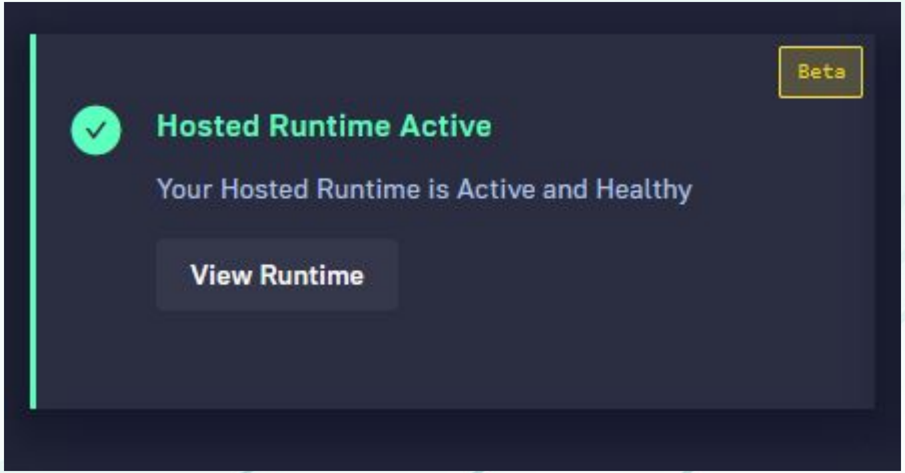
Home

Beta

Your Hosted Runtime is installing right now. It could take a few minutes

40%

Configuring the environment...



Beta

Hosted Runtime Active

Your Hosted Runtime is Active and Healthy

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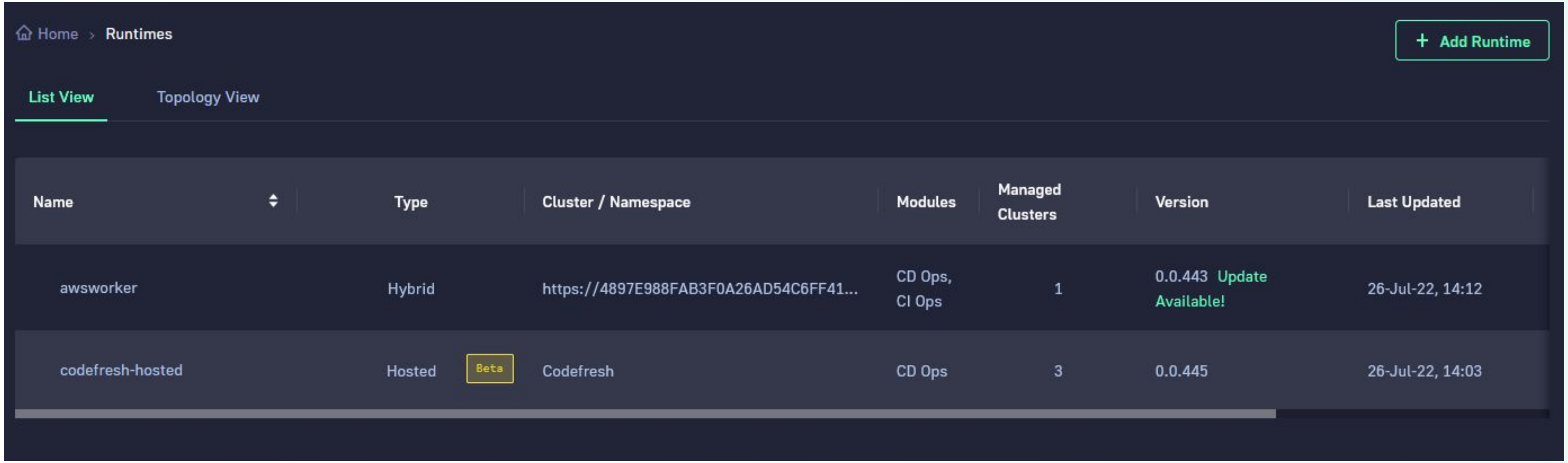
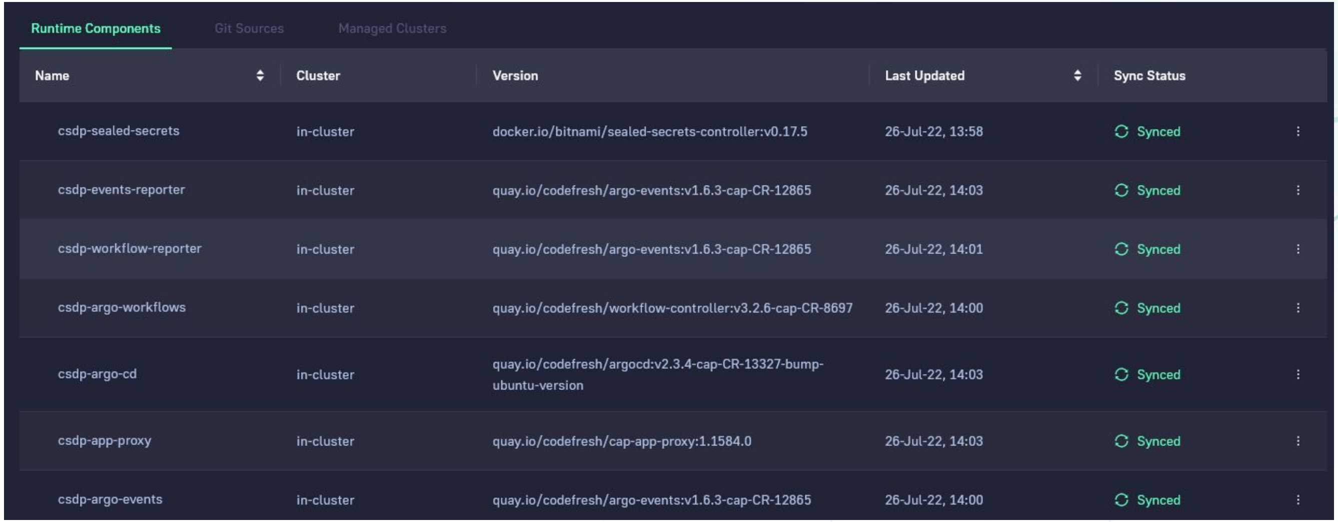
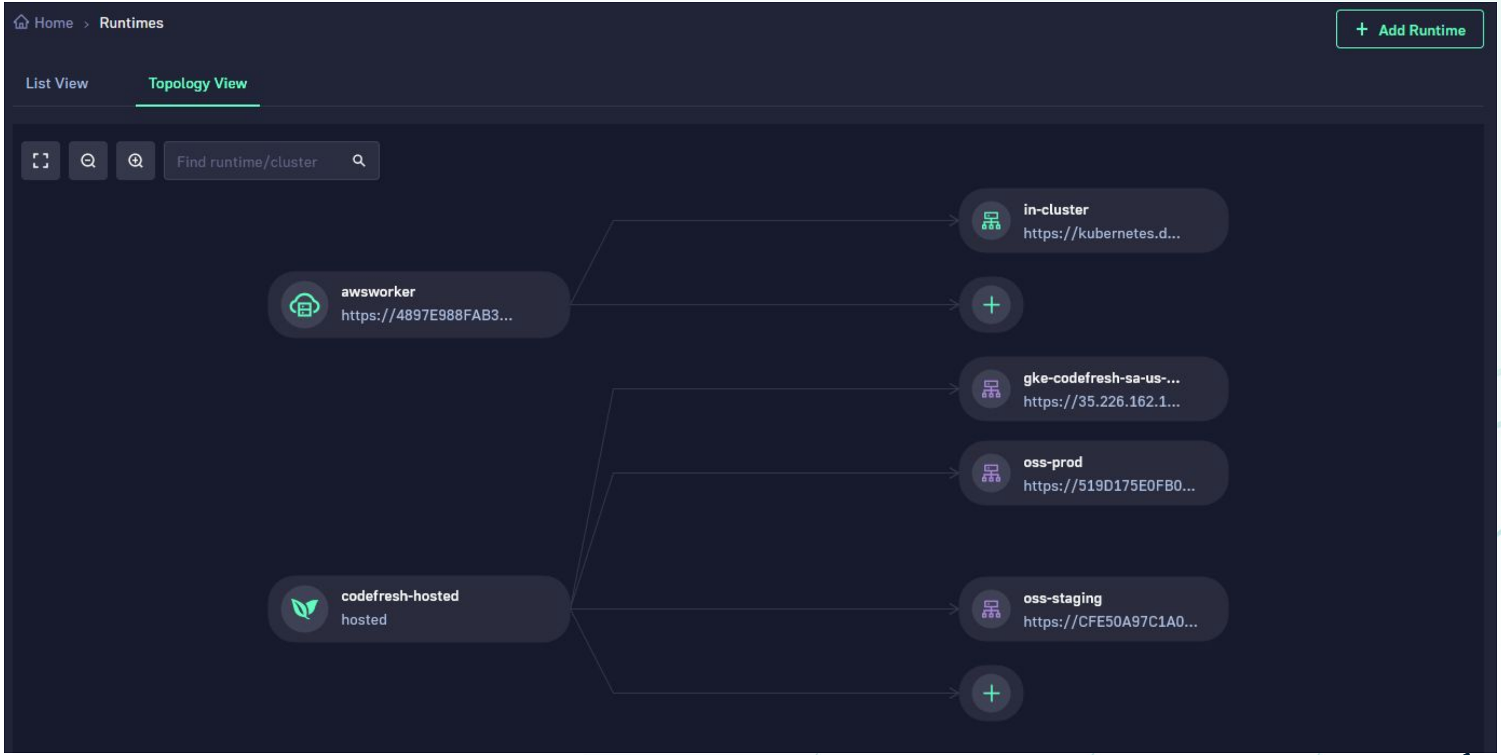


Name	Type	Cluster / Namespace	Modules	Managed Clusters	Version	Last Updated
awsworker	Hybrid	https://4897E988FAB3F0A26AD54C6FF41...	CD Ops, CI Ops	1	0.0.443 Update Available!	26-Jul-22, 14:12
codefresh-hosted	Hosted Beta	Codefresh	CD Ops	3	0.0.445	26-Jul-22, 14:03



Name	Cluster	Version	Last Updated	Sync Status
csdp-sealed-secrets	in-cluster	docker.io/bitnami/sealed-secrets-controller:v0.17.5	26-Jul-22, 13:58	Synced
csdp-events-reporter	in-cluster	quay.io/codefresh/argo-events:v1.6.3-cap-CR-12865	26-Jul-22, 14:03	Synced
csdp-workflow-reporter	in-cluster	quay.io/codefresh/argo-events:v1.6.3-cap-CR-12865	26-Jul-22, 14:01	Synced
csdp-argo-workflows	in-cluster	quay.io/codefresh/workflow-controller:v3.2.6-cap-CR-8697	26-Jul-22, 14:00	Synced
csdp-argo-cd	in-cluster	quay.io/codefresh/argocd:v2.3.4-cap-CR-13327-bump-ubuntu-version	26-Jul-22, 14:03	Synced
csdp-app-proxy	in-cluster	quay.io/codefresh/cap-app-proxy:1.1584.0	26-Jul-22, 14:03	Synced
csdp-argo-events	in-cluster	quay.io/codefresh/argo-events:v1.6.3-cap-CR-12865	26-Jul-22, 14:00	Synced

Connect Deployment clusters to ArgoCD/vcluster



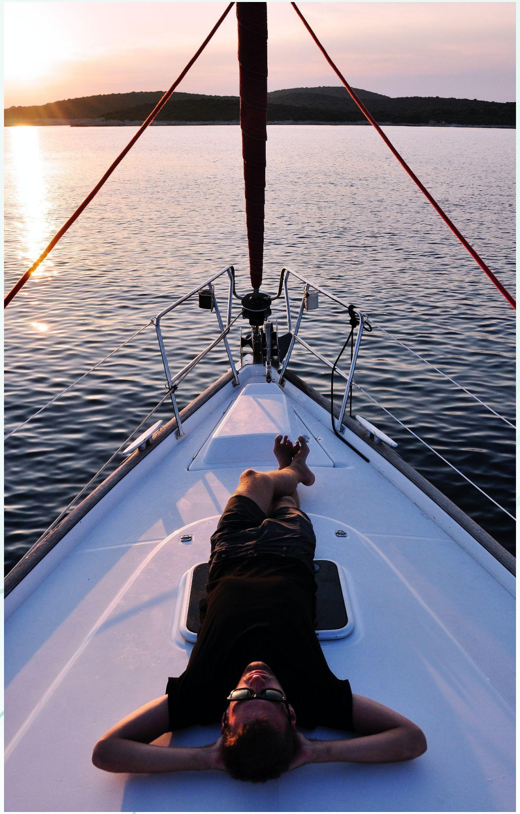
Is it worth it?

Benefits

Photo by Alex Block on Unsplash

Benefits for users

- Your own Argo CD instance on the cloud
- One-click installation
- (Almost) Instant setup
- Zero configuration, zero maintenance
- Flexibility on K8s/Argo CD version
- Friendly management UI with optional SSO



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Benefits for Codefresh

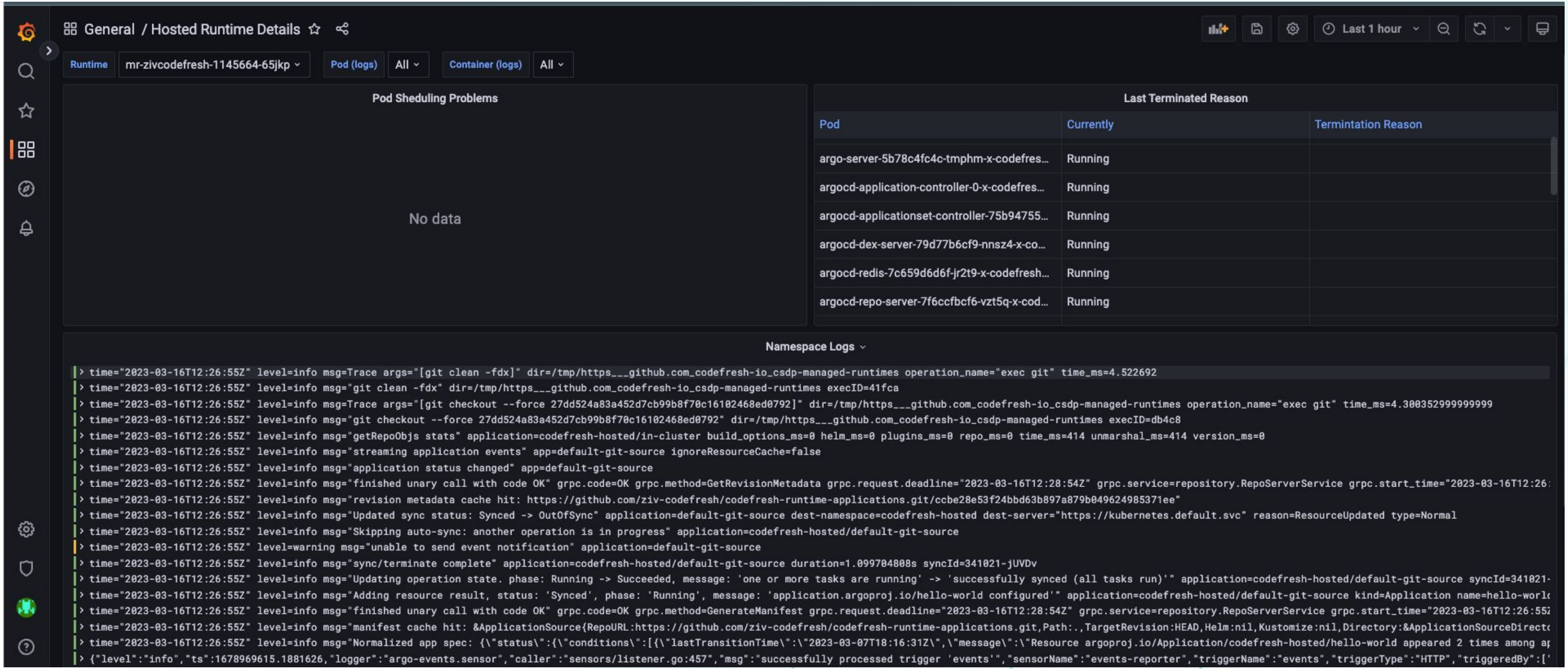
- Centralized setup/monitoring
- Security isolation
- Cost effective/easy to scale
- Resource sharing
- Allow different combinations of K8s version/Argo CD version

Photo by Scott Blake on Unsplash

Monitoring

- Since pods provisioned by workloads deployed on the vcluster are available on the host cluster API - we can use the same tools we use to monitor all other Kubernetes workloads.

- In addition we built our own Prometheus exporter to monitor the hosted runtime health from the platform side


General / Hosted Runtime Details
Last 1 hour
Runtime
mr-zivcodefresh-1145664-65jkp
Pod (logs)
All
Container (logs)
All

Pod Sheduling Problems

No data

Last Terminated Reason

Pod	Currently	Termintation Reason
argo-server-5b78c4fc4c-tmphm-x-codefres...	Running	
argocd-application-controller-0-x-codefres...	Running	
argocd-applicationset-controller-75b94755...	Running	
argocd-dex-server-79d77b6cf9-nnsz4-x-co...	Running	
argocd-redis-7c659d6d6f-jr2t9-x-codefresh...	Running	
argocd-repo-server-7f6ccfbcf6-vzt5q-x-cod...	Running	

Namespace Logs

```
> time="2023-03-16T12:26:55Z" level=info msg=Trace args="[git clean -fdx]" dir=/tmp/https___github.com_codefresh-io_csdp-managed-runtimes operation_name="exec git" time_ms=4.522692
> time="2023-03-16T12:26:55Z" level=info msg="git clean -fdx" dir=/tmp/https___github.com_codefresh-io_csdp-managed-runtimes execID=41fca
> time="2023-03-16T12:26:55Z" level=info msg=Trace args="[git checkout --force 27dd524a83a452d7cb99b8f70c16102468ed0792]" dir=/tmp/https___github.com_codefresh-io_csdp-managed-runtimes operation_name="exec git" time_ms=4.300352999999999
> time="2023-03-16T12:26:55Z" level=info msg="git checkout --force 27dd524a83a452d7cb99b8f70c16102468ed0792" dir=/tmp/https___github.com_codefresh-io_csdp-managed-runtimes execID=db4c8
> time="2023-03-16T12:26:55Z" level=info msg="getRepoObjs stats" application=codefresh-hosted/in-cluster build_options_ms=0 helm_ms=0 plugins_ms=0 repo_ms=0 time_ms=414 unmarshal_ms=414 version_ms=0
> time="2023-03-16T12:26:55Z" level=info msg="streaming application events" app=default-git-source ignoreResourceCache=false
> time="2023-03-16T12:26:55Z" level=info msg="application status changed" app=default-git-source
> time="2023-03-16T12:26:55Z" level=info msg="finished unary call with code OK" grpc.code=OK grpc.method=GetRevisionMetadata grpc.request.deadline="2023-03-16T12:28:54Z" grpc.service=repository.RepoServerService grpc.start_time="2023-03-16T12:26:
> time="2023-03-16T12:26:55Z" level=info msg="revision metadata cache hit: https://github.com/ziv-codefresh/codefresh-runtime-applications.git/ccbe28e53f24bbd63b897a879b049624985371ee"
> time="2023-03-16T12:26:55Z" level=info msg="Updated sync status: Synced -> OutOfSync" application=default-git-source dest-namespace=codefresh-hosted dest-server="https://kubernetes.default.svc" reason=ResourceUpdated type=Normal
> time="2023-03-16T12:26:55Z" level=info msg="Skipping auto-sync: another operation is in progress" application=codefresh-hosted/default-git-source
> time="2023-03-16T12:26:55Z" level=warning msg="unable to send event notification" application=default-git-source
> time="2023-03-16T12:26:55Z" level=info msg="sync/terminate complete" application=codefresh-hosted/default-git-source duration=1.099704808s syncId=341021-jUVDv
> time="2023-03-16T12:26:55Z" level=info msg="Updating operation state. phase: Running -> Succeeded, message: 'one or more tasks are running' -> 'successfully synced (all tasks run)'" application=codefresh-hosted/default-git-source syncId=341021-
> time="2023-03-16T12:26:55Z" level=info msg="Adding resource result, status: 'Synced', phase: 'Running', message: 'application.argoproj.io/hello-world configured'" application=codefresh-hosted/default-git-source kind=Application name=hello-worlc
> time="2023-03-16T12:26:55Z" level=info msg="finished unary call with code OK" grpc.code=OK grpc.method=GenerateManifest grpc.request.deadline="2023-03-16T12:28:54Z" grpc.service=repository.RepoServerService grpc.start_time="2023-03-16T12:26:55Z
> time="2023-03-16T12:26:55Z" level=info msg="manifest cache hit: &ApplicationSource{RepoURL:https://github.com/ziv-codefresh/codefresh-runtime-applications.git,Path:.,TargetRevision:HEAD,Helm:nil,Kustomize:nil,Directory:&ApplicationSourceDirectc
> time="2023-03-16T12:26:55Z" level=info msg="Normalized app spec: {\"status\":{\"conditions\":[{\"lastTransitionTime\":\"2023-03-07T18:16:31Z\",\"message\":\"Resource argoproj.io/Application/codefresh-hosted/hello-world appeared 2 times among ap
> {"level":"info","ts":1678969615.1881626,"logger":"argo-events.sensor","caller":"sensors/listener.go:457","msg":"successfully processed trigger 'events'","sensorName":"events-reporter","triggerName":"events","triggerType":"HTTP","triggeredBy":['
```

Grafana loki

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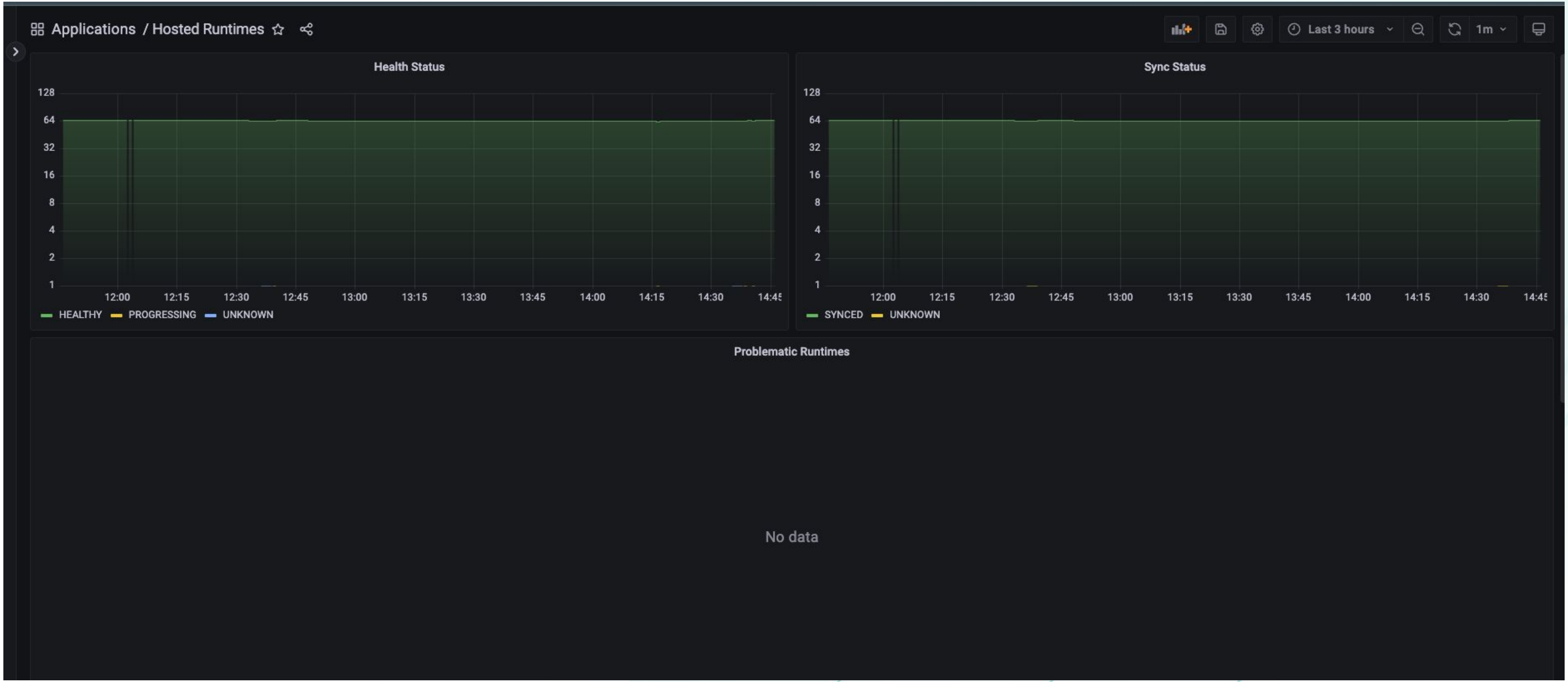


Applications / Hosted Runtimes

Last 3 hours

1m

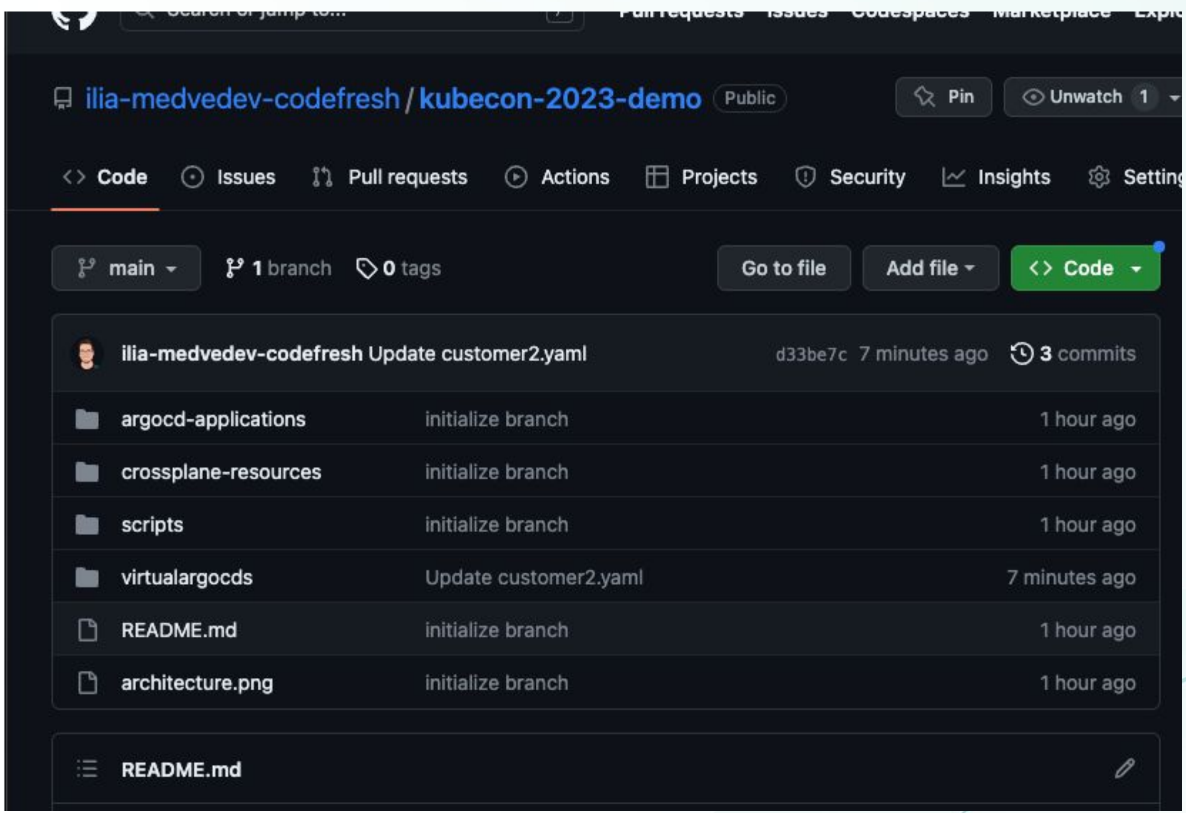
No data

Platform custom exporter to aggregate data on all hosted runtimes health

See it in action

Demo time!

Provisioning and de-provisioning of hosted ArgoCD



ilia-medvedev-codefresh / kubecon-2023-demo Public

ilia-medvedev-codefresh Update customer2.yaml d33be7c 7 minutes ago 3 commits

argocd-applications	initialize branch	1 hour ago
crossplane-resources	initialize branch	1 hour ago
scripts	initialize branch	1 hour ago
virtualargocds	Update customer2.yaml	7 minutes ago
README.md	initialize branch	1 hour ago
architecture.png	initialize branch	1 hour ago

https://github.com/codefresh-contrib/kubecon-eu-2023-demo-crossplane-vcluster.git

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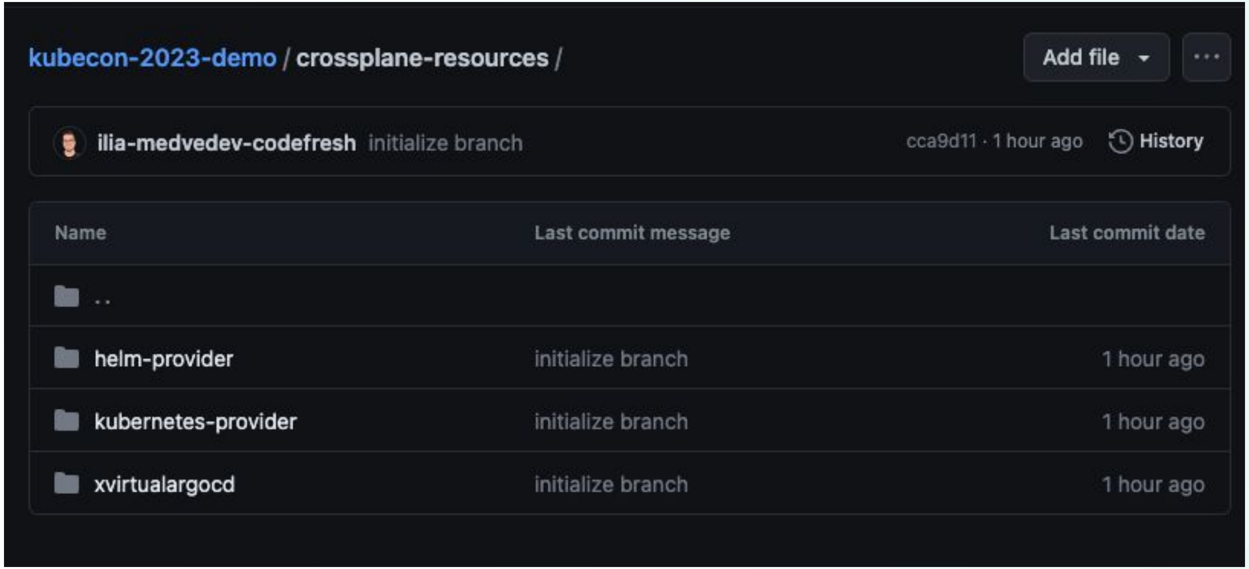
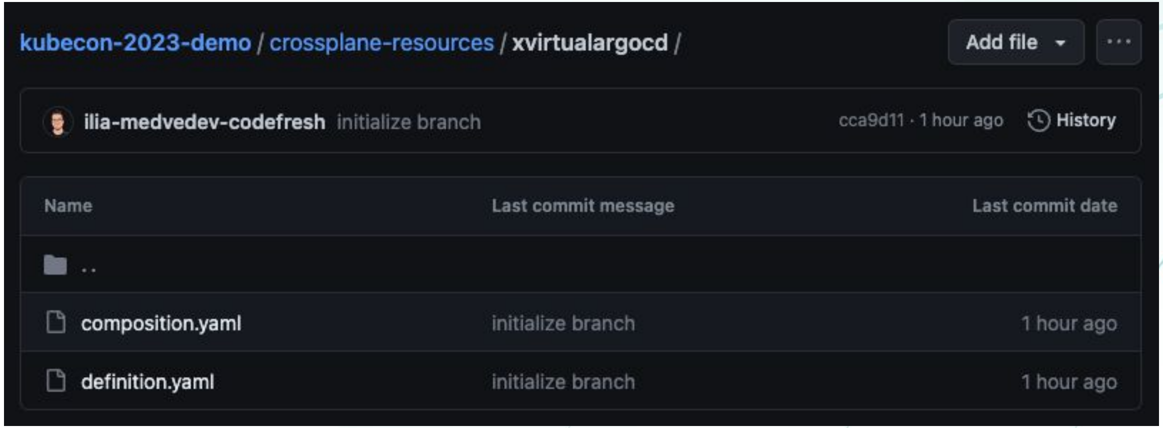


kubecon-2023-demo / crossplane-resources /

ilia-medvedev-codefresh initialize branch cca9d11 · 1 hour ago History

Name	Last commit message	Last commit date
..		
helm-provider	initialize branch	1 hour ago
kubernetes-provider	initialize branch	1 hour ago
xvirtualargocd	initialize branch	1 hour ago

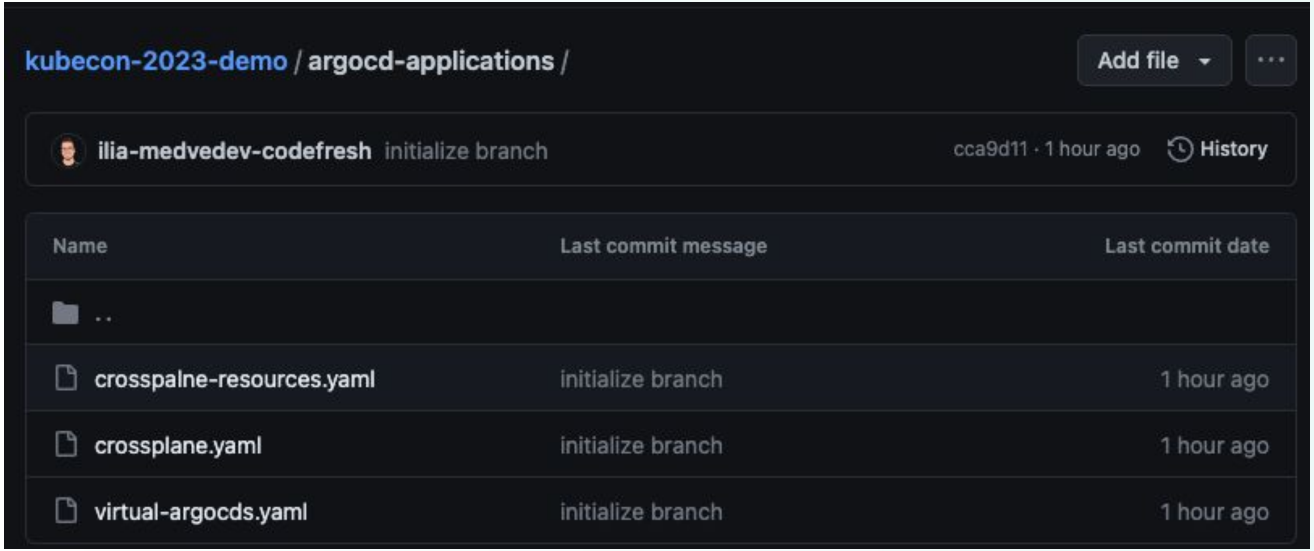


kubecon-2023-demo / crossplane-resources / xvirtualargocd /

ilia-medvedev-codefresh initialize branch cca9d11 · 1 hour ago History

Name	Last commit message	Last commit date
..		
composition.yaml	initialize branch	1 hour ago
definition.yaml	initialize branch	1 hour ago

codefresh

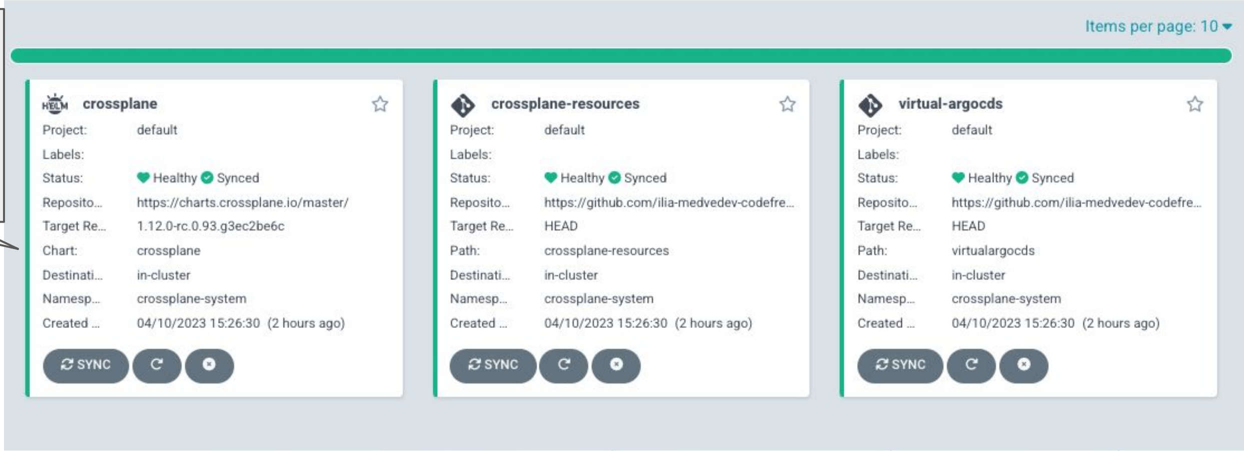


kubecon-2023-demo / argocd-applications /

ilia-medvedev-codefresh initialize branch cca9d11 · 1 hour ago

Name	Last commit message	Last commit date
..		
crosspalne-resources.yaml	initialize branch	1 hour ago
crossplane.yaml	initialize branch	1 hour ago
virtual-argocds.yaml	initialize branch	1 hour ago

Crossplane official Helm chart



Items per page: 10

crossplane

Project: default
Labels:
Status: Healthy Synced
Reposito... https://charts.crossplane.io/master/
Target Re... 1.12.0-rc.0.93.g3ec2be6c
Chart: crossplane
Destinati... in-cluster
Namesp... crossplane-system
Created ... 04/10/2023 15:26:30 (2 hours ago)

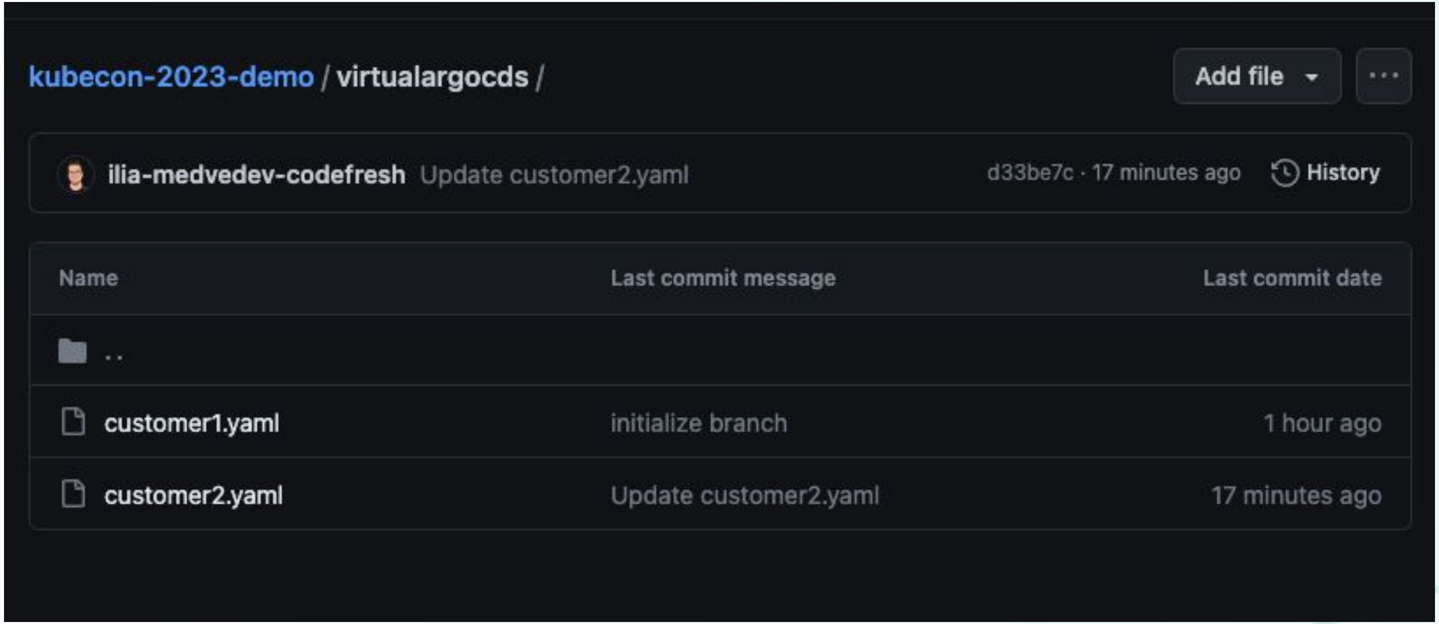
crossplane-resources

Project: default
Labels:
Status: Healthy Synced
Reposito... https://github.com/ilia-medvedev-codefre...
Target Re... HEAD
Path: crossplane-resources
Destinati... in-cluster
Namesp... crossplane-system
Created ... 04/10/2023 15:26:30 (2 hours ago)

virtual-argocds

Project: default
Labels:
Status: Healthy Synced
Reposito... https://github.com/ilia-medvedev-codefre...
Target Re... HEAD
Path: virtualargocds
Destinati... in-cluster
Namesp... crossplane-system
Created ... 04/10/2023 15:26:30 (2 hours ago)

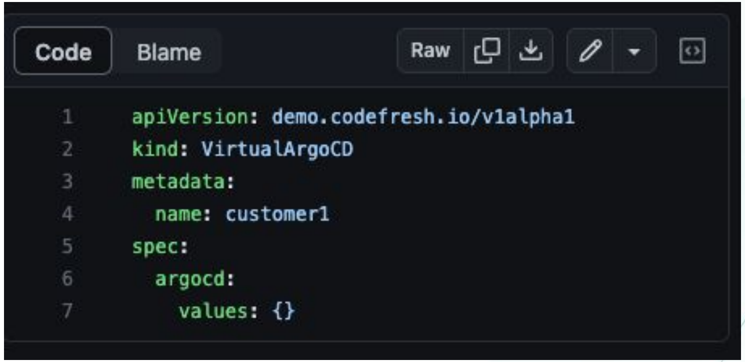
codefresh



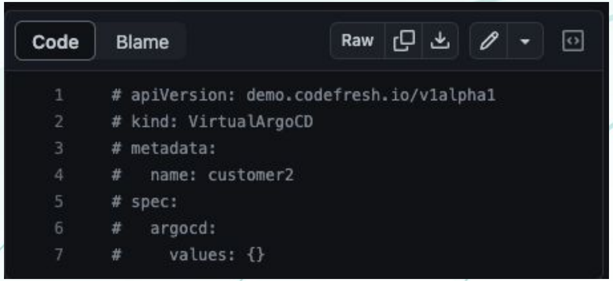
kubecon-2023-demo / virtualargocds /

ilia-medvedev-codefresh Update customer2.yaml d33be7c · 17 minutes ago

Name	Last commit message	Last commit date
..		
customer1.yaml	initialize branch	1 hour ago
customer2.yaml	Update customer2.yaml	17 minutes ago

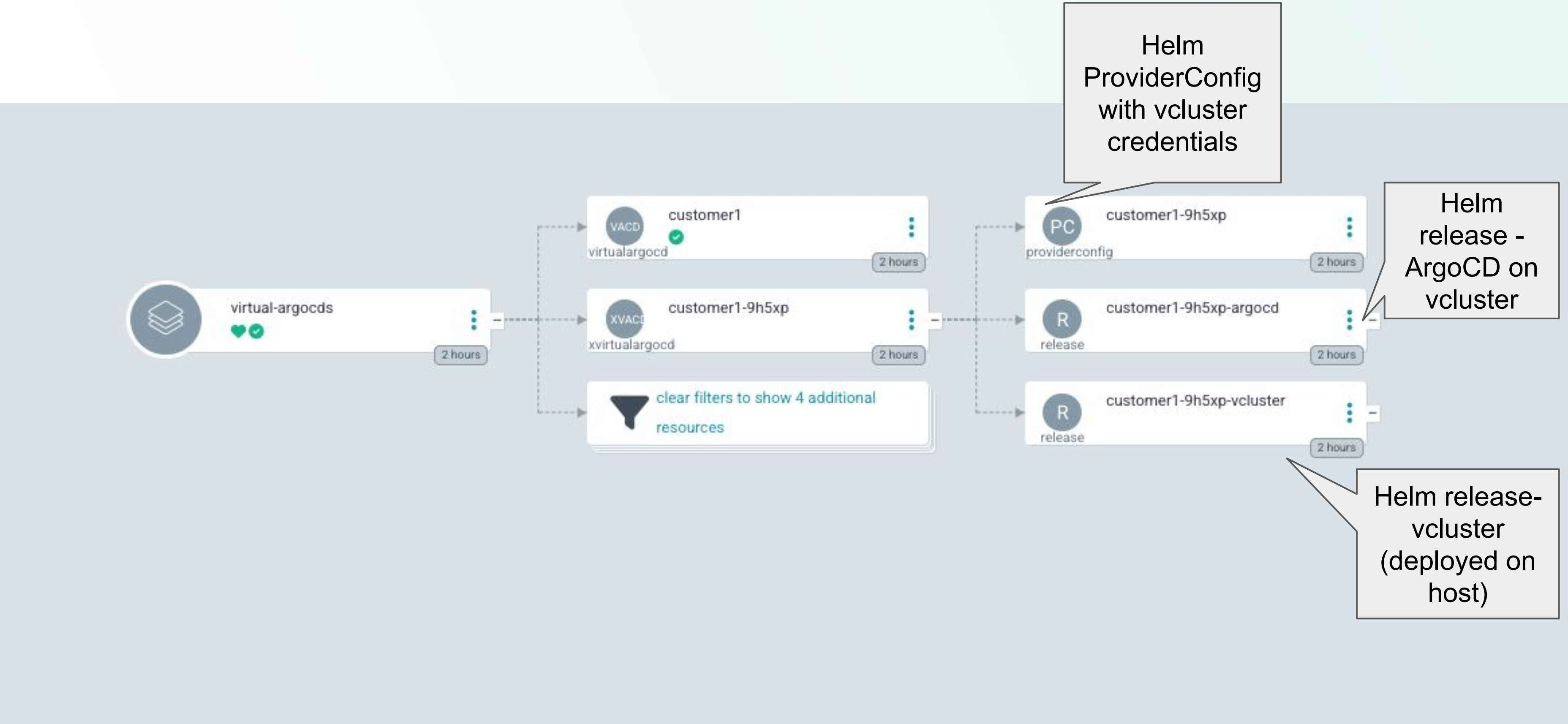


```yaml
apiVersion: demo.codefresh.io/v1alpha1
kind: VirtualArgoCD
metadata:
  name: customer1
spec:
  argocd:
    values: {}
```



```yaml
# apiVersion: demo.codefresh.io/v1alpha1
# kind: VirtualArgoCD
# metadata:
#   name: customer2
# spec:
#   argocd:
#     values: {}
```

codefresh



Helm ProviderConfig with vcluster credentials

Helm release - ArgoCD on vcluster

Helm release- vcluster (deployed on host)

Resources

- vcluster.com (also loft.sh)
- crossplane.io (also upbound.io)
- codefresh.io
- learning.codefresh.io (Argo CD certification)

Questions?

Scan QR and give us feedback please!